

ASIAN BOLBOCERATINE SCARABS OF THE GENUS *BOLBOGONIUM* BOUCOMONT (COLEOPTERA: GEOTRUPIDAE)

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With 43 figures and one frontis-piece

ABSTRACT

After a brief introduction to and technical remarks on this first paper in a series on the classification of Asian Bolboceratini, the genus *Bolbogonium* Boucomont is revised. *Bolbogonium* is here raised to generic rank, diagnosed, and the 10 known species are keyed, described and illustrated. The distribution of the genus is mainly Oriental. The three forms previously named are *Bolbogonium impressum* (Wiedemann) comb. nov., *punctatissimum* (Westwood) comb. nov., and *triangulum* (Westwood) comb. nov. (type-species). Of *impressum* and *triangulum* new records are given. The following new species are treated: *addendum* (Vietnam), *bicornutum* (India), *howdeni* (India, Pakistan), *insidiosum* (India), *pseudopunctatissimum* (India), *scurra* (India), and *wiebesi* (Burma).

A survey of characters and character states relevant to a supraspecific classification of the world Bolboceratini is given in an appendix.

INTRODUCTION

This paper is the first in a series on the Asian representatives of the tribe Bolboceratini (sensu Howden & Martinez, 1963). Both this series and related work are intended to contribute to a world-wide reclassification of the group, particularly on the supraspecific level.

During the past few years I have tried to assemble as many Asian bolboceratines as possible, but the number of specimens so far received from many institutions and individuals remained highly disproportional to my efforts, particularly from the geographic point of view. This is, among other factors, certainly due to the retiring habits of bolboceratines and to regional undercollecting; vast areas, although in all probability inhabited by bolboceratines, do not seem to have produced a single specimen. Consequently, the taxonomy and distribution of these scarabs cannot be dealt with in a final or authoritative manner, and sooner or later supplementary results are to be expected.

Reliable data on the bionomics of the Asian species are not available, but undoubtedly in the day-time the animals hide in deeply excavated terrestrial burrows, as their European and North American relatives notoriously do (for a summary of the known life-histories, see Howden, 1955: 296—299); they might as well feed on and provide their brood burrows with subterranean fungi or other

vegetable matter. The label data indicate that several of the specimens before me were attracted to light; actually, the majority may have been collected in this way.

The only comprehensive study on Asian Bolboceratini ever published was written by Westwood (1852), who treated 22 species, omitting 7 names published by earlier workers. Consultation of Westwood's specimens proved indispensable, but, unfortunately, part of the original material could not be traced. Later workers added 15 new species-group names based on material from tropical and eastern Asia, bringing the total to 44, of which two have been synonymized. The species were accommodated in seven genus-group taxa, including one subgenus. The last complete genus-group classification was given by Boucomont (1911) in a treatise on the world fauna. He then proposed the subgenus *Bolbogonium* for *Bolboceras triangulum* Westwood. The taxonomy of this group, here raised to generic rank, is worked out below.

The publication of a modern classification of the Asian genus-group taxa is postponed, since this would entail the introduction of new names before the taxonomy on the species-group level has been established to a reasonable degree. A second reason for postponing is the fact that Howden and I are trying to work out the classification of the world fauna. Some of the Asian groups are closely related to or have members in the fauna of tropical Africa, and the taxonomic characters of these are still under investigation. Despite this omission, the generic diagnosis of *Bolbogonium* given hereafter warrants a correct recognition, as the features included implicitly match those of allied groups to be treated in forthcoming papers.

In an appendix I give an analysis of the characters relevant to a comprehensive classification of the world fauna, which may serve as a matrix for diagnoses of genus-group taxa. Sixty-six characters are listed; 23 unconditional and 8 conditional characters are suggested to be of primary importance in a supraspecific classification. This does not necessarily mean that they are constant in all groups. Although I have included classified character states derived from bolboceratines of all the zoogeographic regions, the present survey is undoubtedly capable of improvement and extension. The Australasian fauna seems incompletely surveyed, at least as far as cephalic and pronotal armature is concerned. The classification of the male genitalia is strongly simplified, mainly because of the lack of information on the homologies of their elements. Most statements are phrased in a generalized manner, and in actual cases need further specification. To give only one example, I have no pretention at all to present a complete survey of the excessive diversity in pronotal armature among Bolboceratini (characters 18 et seqq.). Only a few of the characters listed can be used for phylogenetic research.

PRESENTATION OF DATA

The descriptive work was done with the aid of a Wild M5 binocular microscope (magnifications $\times 6$ - $\times 100$) plus drawing apparatus. Most distances and densities were established by comparing the optical picture with verified scales viewed through the drawing apparatus. Cephalic distances and densities were established in full-face view, i.e. with the cephalic plane perpendicular to the optical axis.

Other measurements and counts, unless mentioned otherwise, were established after placing the specimen with the plane touching the scutellum perpendicular to the optical axis. The absolute values must be interpreted very carefully, since measurements on such convex scarabs like *Bolboceratini* are inherently inexact.

The information in my descriptions varies slightly according to genus, number and status of specimens available, and according to quantity and nature of information in previous publications. In the present revision of *Bolbogonium* detailed descriptions of all the species are given. As a rule little attention is paid to the pectoral and abdominal characters. The abdomens of many specimens had to be extracted in order to examine the genitalia. In *Bolbogonium* I suspect that at least one species exhibits sexual dimorphism in its clypeofrontal ornamentation (see below, section on the genus, infrageneric dissimilarities, character 2); in some other species, however, the sexes are definitely similar. I noticed that some workers had sexed their specimens incorrectly, this being due to the small size of the phallus in the groups concerned; in several instances the abdomen had been ruined completely, or it was simply missing.

Both the photographs of the general appearance and the drawings of the cephalic and pronotal contours serve to relieve the descriptions of some information difficult to communicate verbally. Unless mentioned otherwise, all the scale lines given with the figures represent 1 mm. Some of the quantitative data in the specimen descriptions have potential reference value only.

Clearly different size classes of sculptural elements (e.g. punctures) may be mixed on a particular surface. In the descriptions this is indicated as double (two size classes occur), triple (three size classes occur), etc., the elements being termed primary (the largest), secondary, tertiary, etc. for each particular surface.

In *Bolboceratini* the number of fossorial elevations on the outer side of middle and hind tibiae is difficult to establish. The height of these elevations decreases from apex to base, and usually proximally only a number of spines indicate their position. In the descriptions the number of indistinct proximal fossorial elevations (usually those lacking a continuous crest) is placed between parentheses.

Despite poor collection data, the localities of the species are mapped; the distribution of the genus (shaded, fig. 1) is hypothetical.

The following abbreviations concerning the location of *Bolbogonium* material are used:

- BH — Zoologisches Museum der Humboldt-Universität, Berlin;
- BM — British Museum (Natural History), London;
- CNC — Canadian National Collection, Ottawa;
- L — Rijksmuseum van Natuurlijke Historie, Leiden;
- P — Muséum National d'Histoire Naturelle, Paris;
- M — Zoologische Staatssammlung, Munich;
- SMT — Staatliches Museum für Tierkunde, Dresden.

Genus *Bolbogonium* Boucomont stat. nov.

Bolbogonium Boucomont, 1911: 340 (as subgenus of *Bolboceras* Kirby; type-sp. *Bolboceras triangulum* Westw.), 342 (in key).

Generic diagnosis. — Middle coxae widely separated by anterior lobe of metasternal disc, which is pyriform (fig. 28). Glabrous shiny area on proximal side of club segment 1 large, and distinctly separated from surrounding pubescent surface (fig. 27). Seven striae between suture and humeral umbone, all virtually reaching base (fig. 26). Vertex laterally limited by arcuate crest, posterior margin more or less concavely acclivous. Pronotum anteriorly with either simple or more complex, characteristically shaped impression, usually surmounted by simple or bisinuate crest (i.e., at most with single median protrusion).

Outer margin of right mandible with distinct arcuate lobe. Labrum thickened, surface frequently heavily sculptured. Clypeal outline (dorsal view) variant: semicircular, semielliptic or trapeziform, with or without anterolateral or antero-median marginal protrusion(s). Perimarginal ridge of clypeus variably distinct. Clypeus at most with low median longitudinal elevation; clypeofrontal transition or frons with either single protrusion or set of protrusions, always situated discally. Head never with simple transverse ridge between eyes. Frontovertex with or without impression(s). Anterior border of eye-canthus marginate. Eyes entire, not

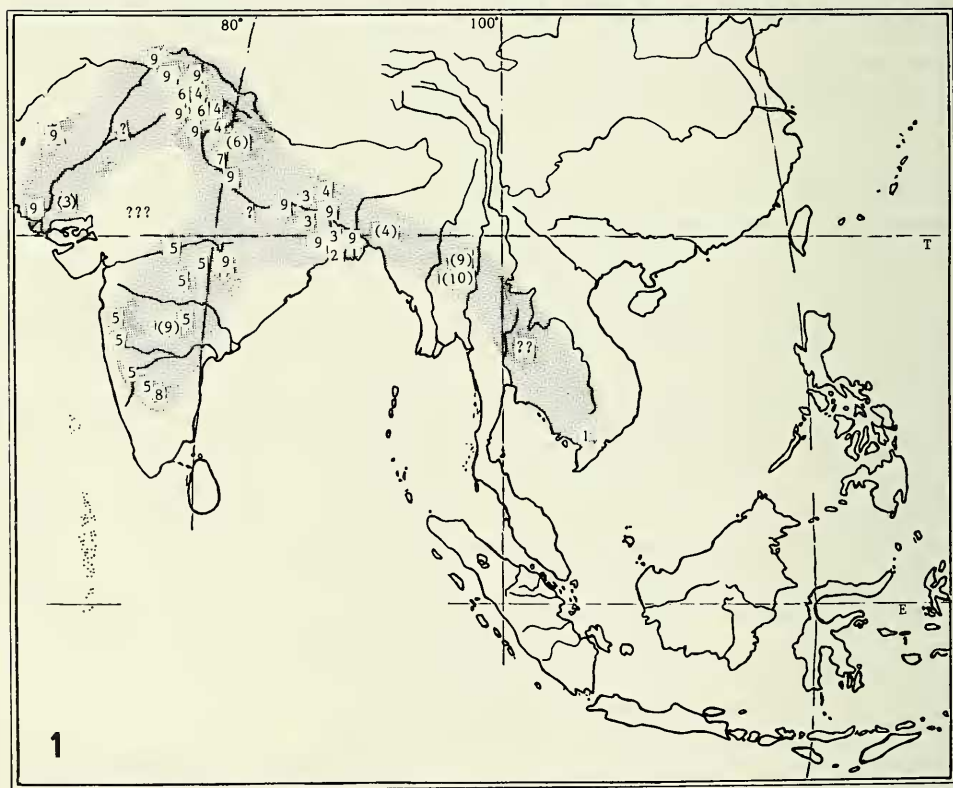


Fig. 1. Approximate known distribution of *Bolbogonium* (shaded) and its species. 1, *addendum*; 2, *bicornutum*; 3, *howdeni*; 4, *impressum*; 5, *insidiosum*; 6, *pseudopunctatissimum*; 7, *punctatissimum*; 8, *scurra*; 9, *triangulum*; 10, *wiebesi*. Numbers between parentheses refer to insufficiently detailed locality data (usually country or province records).

divided into two parts. Pronotal base marginate (at least medially). Scutellum virtually triangular, ratio l/w 1—1.5. Elytral base unmodified; epipleuron reaching apicosutural angle. Elytral interstriae scarcely convex, striae at most weakly impressed. Antennal club unmodified; outline approximately ovate (ratio l/w of lamellae exceeding 1.5; fig. 27). Prosternum unmodified. Subapical fossorial elevations of middle and hind tibiae (fig. 29) with either angulate or arcuate crest; at least two complete non-apical fossorial elevations present. Metatarsus of middle and hind legs relatively short, length not exceeding maximum width of tibial apex. Parameres small, poorly sclerotized, simple (fig. 31). Body medium-sized, length roughly around one cm. Colour uniformly brown, orange, or yellow.

Type-species. — *Bolboceras triangulum* Westwood, by original designation.

Affinities. — *Bolbogonium* species superficially resemble *Bolboceras indicum* Westwood and its allies. They differ, however, greatly in characters of the antennal club, striation on the elytral base, shape of metasternum, etc. The primary set of properties, as mentioned in the first paragraph of the above diagnosis, warrants a generic status, and Boucomont's subgenus is here treated accordingly.

Infrageneric dissimilarities. — The following properties proved to be important in a classification of *Bolbogonium* (see comparative drawings):

- 1, shape of clypeus simply trapeziform (a), clypeus with produced anterolateral angles (b), or clypeus more or less produced anteromedially (c).
- 2, detailed structure of clypeofrontal ornamentation; frons with variably developed transverse ridge (a), with two small, isolated (paramedian) tubercles (b), with three small, isolated tubercles (c), with simple median tubercle (d), with a different ornamentation (e), — note that this may be a sexual character.
- 3, frontolateral ridge distinct (a), or (sub)obsolete (b).
- 4, vertex generally flat (a), or with distinct U-shaped impression (b).
- 5, anteromedian impression of pronotum absent or superficial (a), or antero-median impression well pronounced (b).
- 6, conditional on 5 (b); pronotal impression with large, well-defined (sub)horizontal space immediately behind anterior border (a), or such a horizontal space absent (b).
- 7, bisinuate crest of pronotum absent or ill-defined (a); or pronotum with distinct crest, which is either moderately defined (b), or sharply defined (c).
- 8, basal margin of pronotum completely ridged (a), or incompletely ridged (usually medially only) (b).
- 9, non-apical fossorial elevations on middle and hind tibiae with either arcuate (a), or angulate (emarginate, bilobate) crest (b).
- 10, sculpture of dorsum — not classified.

The structure of the male genitalia is rather simple; they are generally poorly sclerotized, and consequently provide no characters of practical diagnostic value.

The distribution of the classified character states over the species recognized within *Bolbogonium* is given in the following table.

On these characters four species-groups may be recognized within *Bolbogonium*, viz. the *bicornutum* group (with *addendum* and *bicornutum*), the *triangulum* group (with *pseudopunctatissimum*, *triangulum* and *impressum*), the *insidiosum* group (with

Character no.	1	2	3	4	5	6	7	8	9
<i>addendum</i>	a	a	b	a	a	(b)	a	b	a
<i>bicornutum</i>	a	a	b	a	a	(b)	ab	b	a
<i>pseudopunctatissimum</i>	b	a	a	a	a	a	a	b	a
<i>triangulum</i>	b	b/e	a	a	b	a	a-b	a	a
<i>impressum</i>	b	d	a	a	b	a	b	a	a
<i>scurra</i>	a	e	ab	a	b	b	b	b	a
<i>insidiosum</i>	c	e	a	b	b	b	b	b	a
<i>punctatissimum</i>	c	b	b	a	b	b	b	a	b
<i>howdeni</i>	c	c	b	a	b	b	b	a	b
<i>wiebesi</i>	c	d	b	a	b	b	c	a	b

insidiosum and *scurra*), and the *punctatissimum* group (with *punctatissimum*, *howdeni* and *wiebesi*).

There is no basis to discuss the phylogeny of *Bolbogonium*, since the significance of most characters is unknown.

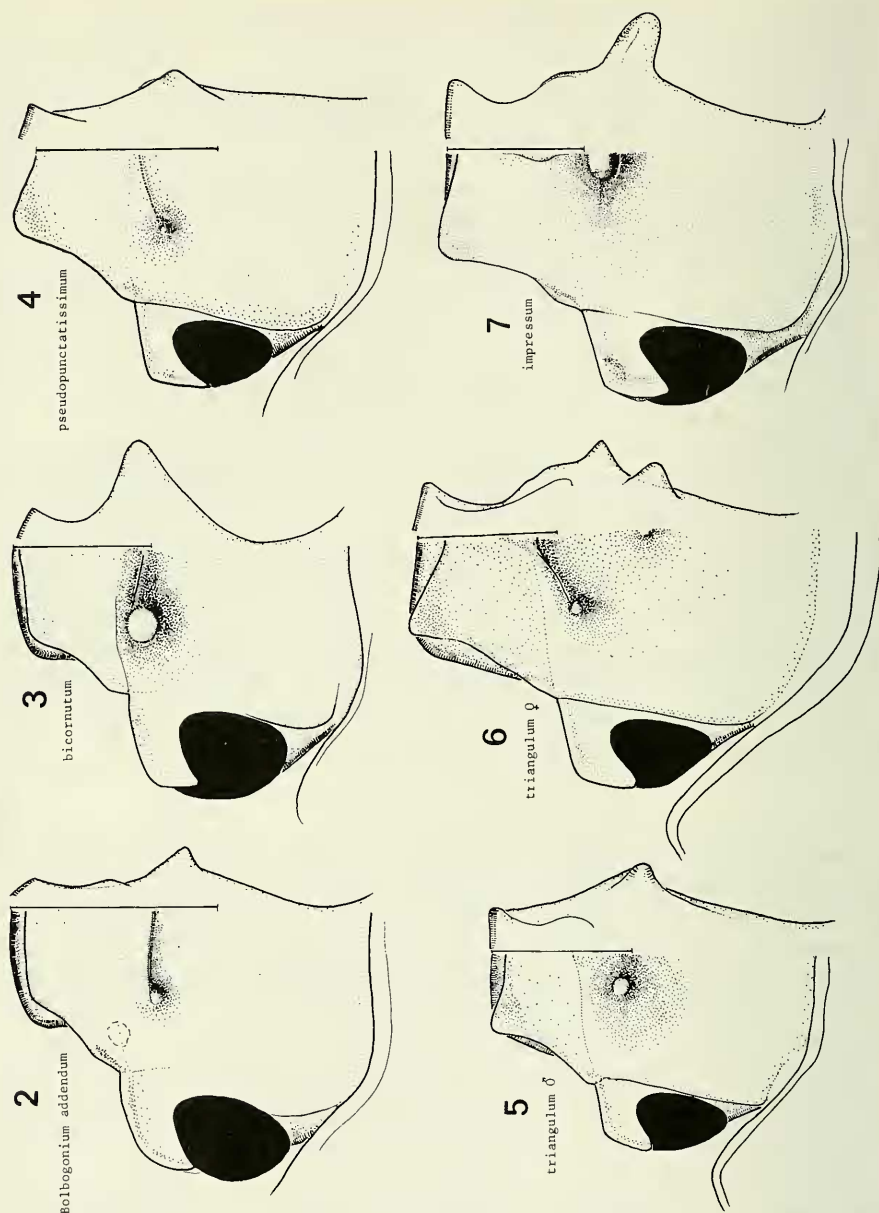
Distribution. — Oriental, transgression into Palaearctic (fig. 1): 10 species recorded from localities ranging from Pakistan to South Vietnam, no material seen from North of the Himalaya.

Bionomics. — Apparently nocturnally active; found "in soil"; record from dung considered casual.

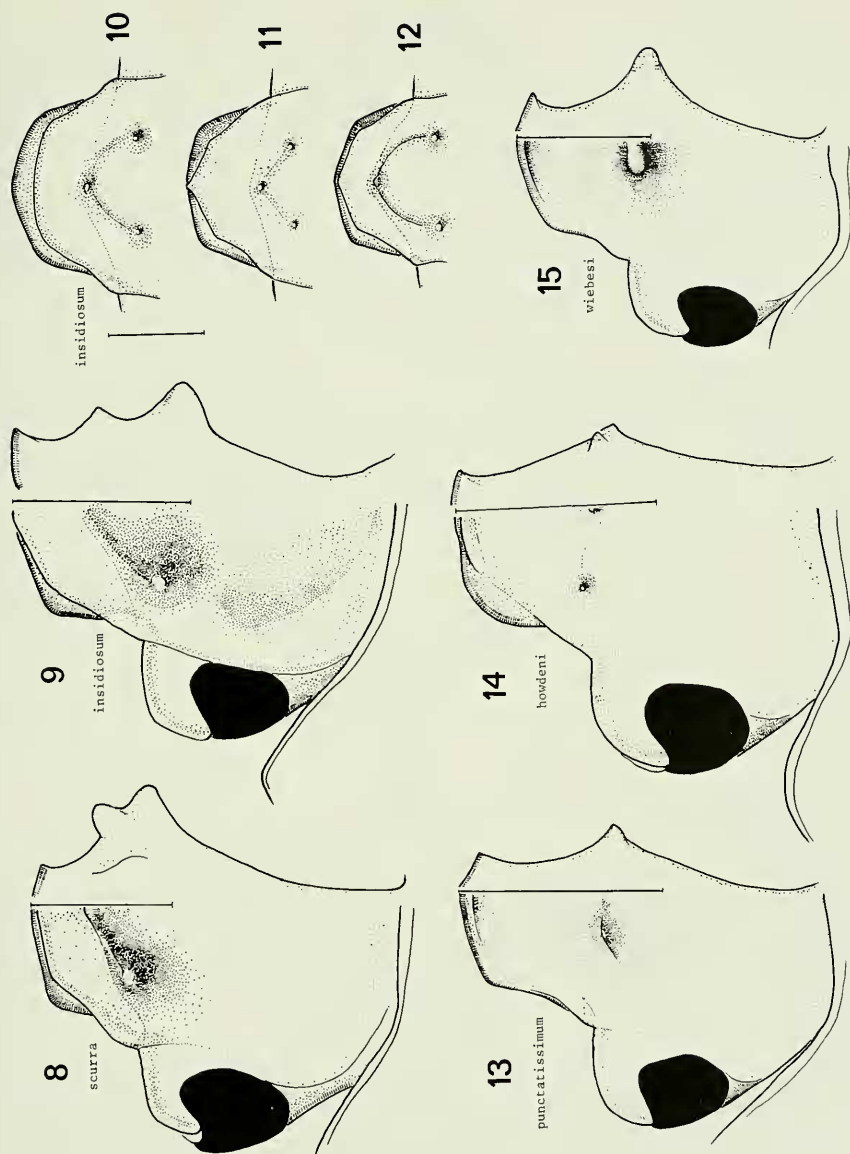
Key to the species of *Bolbogonium* (see figs. 2—25)

1. Anterolateral angles of clypeus distinctly raised, produced. Impression of anterior side of pronotum with (sub)horizontal base. Vertex lacking symmetrical impression(s). If there are only two frontal tubercles, these are not connected by a conspicuous saddle. Subapical fossorial elevations of middle and hind tibiae with arcuate crest. Pronotal base completely marginate (except in *pseudopunctatissimum*). Frontolateral ridge usually distinct. Eye-canthus with more or less distinct anterolateral angle 2
- Anterior border of clypeus either approximately straight with simply obtuse anterolateral angles, or rounded with obsolete anterolateral angles. Impression of anterior side of pronotum lacking well-defined horizontal base 5
2. Frons with well-pronounced median tubercle between eyes, and a longitudinal callosity on clypeus. Pronotal crest distinct, and shifted to posterior half of pronotum. Length 9.5—13 mm. — N. India *impressum* (p. 92)
- Frons with set of two or three elevations 3
3. Frons between eye-canthi with pair of low tubercles separated by about half the intergenal distance, connected by arcuate ridge. Pronotal crest ill defined, and shifted to posterior half of pronotum. Length 7.5—11 mm. — N. India *pseudopunctatissimum* (p. 90)
- Frons with different set of elevations, or with pair of approximated tubercles 4

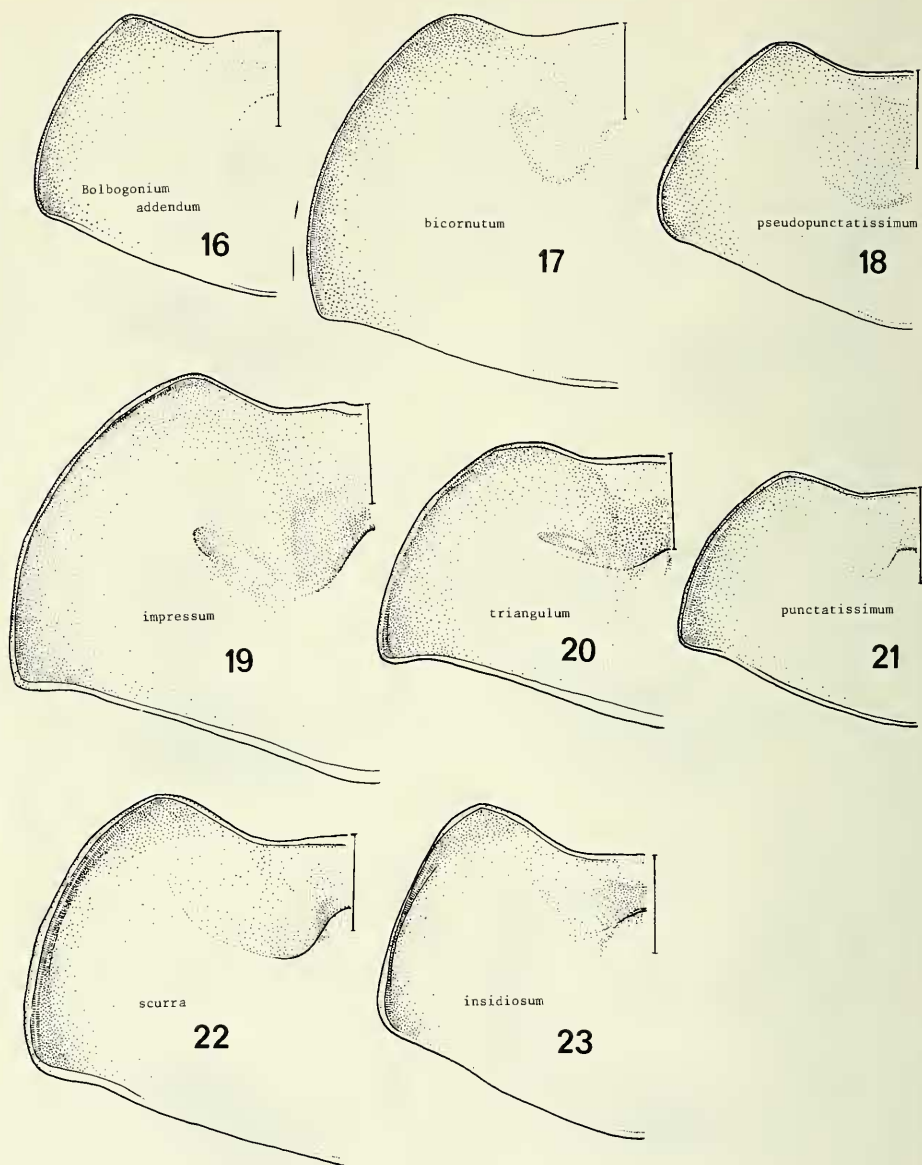
4. Frons with pair of approximated tubercles. Length 7.5—10 mm. — Burma, India, Pakistan *triangulum* ♂ (p. 91)
- Frons with transverse ridge directly behind clypeofrontal suture, plus small central tubercle. Length 7.5—12 mm. — Burma, India, Pakistan *triangulum* ♀ (p. 91)
5. Frons with pair of tubercles connected by variably developed rectilinear elevation. Anterolateral angles of clypeus distinct. Pronotal base medially feebly marginate. Frontolateral ridge indistinct 6
- Frons with 1—3 tubercles, either isolated or connected by more or less pronounced V- or U-shaped elevation. Anterolateral angles of perimarginal ridge of clypeus (sub)obsolete, and clypeal margin usually either rounded, or with some anteromedian protrusion. If anterolateral angles distinct, frons with V-shaped elevation. Elytral striae distinctly impressed 7
6. Frons with pair of widely separated small tubercles connected by vague ridge. Pronotum slightly impressed behind anteromedian border. Posterior declivity of vertex low. Length 8 mm. — S. Vietnam *addendum* (p. 87)
- Frons with pair of widely separated stout tubercles connected by saddle. Anterior declivity of pronotum with characteristic impression. Length 11.5 mm. — NE. India *bicornutum* (p. 89)
7. Frons with single transverse tubercle between eye-canths. W-shaped crest of pronotum sharply defined. Clypeus with transverse antero-marginal costa. Vertex lacking pronounced impression. Subapical fossorial elevations of middle and hind tibiae with arcuate crest. Length 10 mm. — Burma *wiebesi* (p. 99)
- Frons with two or three tubercles, free or connected by ridge 8
8. General elevation of clypeofrons with one anterior protrusion and a pair of posterior tubercles; anterior protrusion frequently obsolescent, occasionally only leaving its costiform connection between the posterior paramedian tubercles; clypeofrontal suture (as far as visible) medially slightly shifted forward. Pronotal base medially feebly marginate. Frontolateral ridge usually distinct. Subapical fossorial elevations on middle and hind tibiae with arcuate crest. Vertex sparsely punctate 9
- Frons with two or three small, isolated tubercles between eye-canths. Pronotal base completely marginate. Frontolateral ridge indistinct. Distal fossorial elevations of middle and hind tibiae angulate-emarginate or bilobate. Vertex densely punctate 10
9. Surface of vertex plane or nearly so. Elytral striae coarsely punctate, punctures sharply defined, stria 2 obsolete slightly past scutellar apex. Clypeus trapeziform, apex non-protuberant, slightly curved. Frontal elevation a wide-legged V. Length 8.5—11 mm. — C. India *scurra* (p. 94)
- Surface of vertex symmetrically impressed, sparsely punctate. Elytral striae moderately punctate, stria 2 extending further caudad. Clypeus with rounded, more or less obsolete anterolateral angles, apex frequently protuberant. Frontal elevation usually U-shaped, never a wide-legged V. Length 7—11 mm. — S. and C. India *insidiosum* (p. 95)



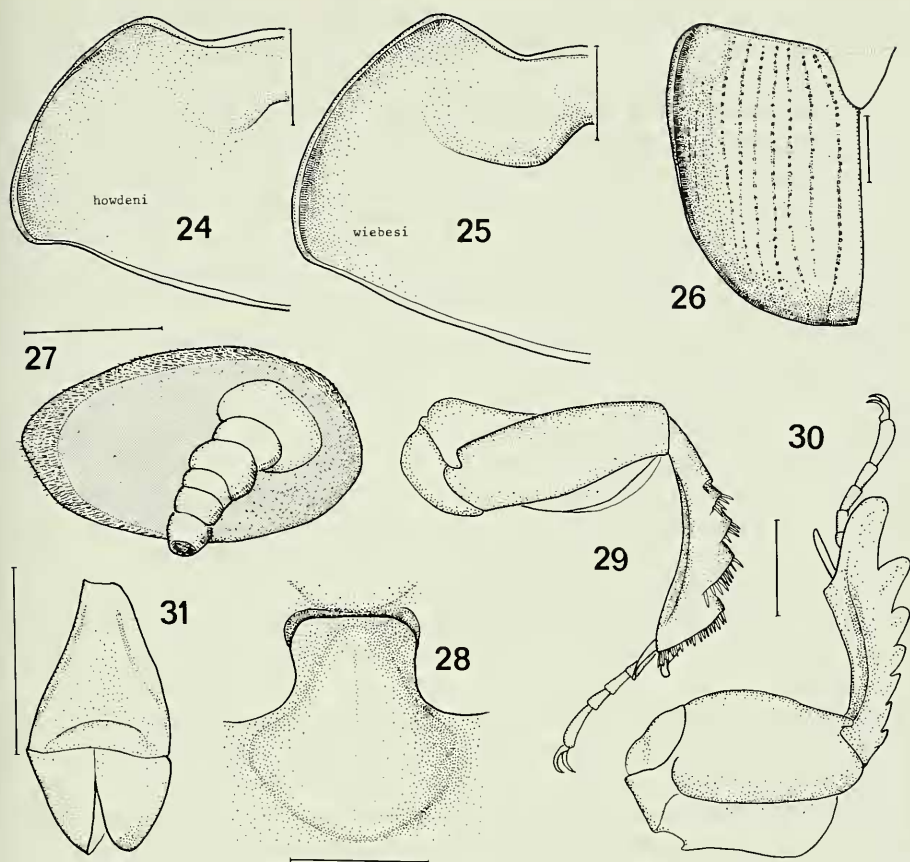
Figs. 2—7. Contours of left half of head (dorsal), with approximate left side profile. 2, *Bolbogonium addendum*, holotype; 3, *bicornutum*, holotype; 4, *pseudopunctatissimum*, holotype; 5, *triangulum*, ♂ Bengal; 6, ditto, ♀ Karachi; 7, *impressum*, ♂ Bengal.



Figs. 8—15. Contours of left half of head (dorsal), with approximate left side profile. 8, *Bolbogonium scurra*, holotype; 9, *insidiosum*, holotype; added figs. 10—12, polymorphism in shape of clypeofrons: Nagpur (10), Hoshangabad (11), and Coimbatore (12); 13, *punctatissimum*, holotype; 14, *howdeni*, holotype; 15, *wiebesi*, holotype.



Figs. 16—23. Contours of left half of pronotum (dorsal). 16, *Bolbogonium addendum*, holotype; 17, *bicornutum*, holotype; 18, *pseudopunctatissimum*, holotype; 19, *impressum*, ♂ Bengal; 20, *triangulum*, ♂ Bengal; 21, *punctatissimum*, holotype; 22, *scurra*, holotype; 23, *insidiosum*, holotype.



Figs. 24—25. Contours of left half of pronotum (dorsal). 24, *Bolbogonium howdeni*, holotype; 25, *wiebesi*, holotype. Figs. 26—31. Details of *B. triangulum* (26, 28—30, ♂ Haldwani; 27, ♀ Bengal; 31, ♂ Bengal). 26, left elytron, and scutellum; 27, flagellar segments and inward surface of first club segment; 28, metasternal plate; 29, left hind leg; 30, left fore leg; 31, phallus, dorsal. Scale line with fig. 27=0.5 mm, others 1 mm.

10. Frons with three small transversely collinear tubercles between eye-canths. Head and pronotum crowdedly punctate or punctate-rugulate throughout. Elytral derm moderately coarsely wrinkled, notably on lateral declivity. Length 9-11 mm. — N. India, S. Pakistan *howdeni* (p. 97)
- Frons with pair of small tubercles between eye-canths. Pronotum densely or crowdedly punctate. Lateral declivity of elytron not conspicuously wrinkled. Length 8 mm. — N. India *punctatissimum* (p. 96)

***Bolbogonium addendum* sp. nov. (figs. 2, 16, 32)**

Description (holotype, female). — Approximate length 8, width 5, height 4 mm. Orange-brown, shiny; tips, ridges, margins, sutures more or less infuscated; pilosity yellowish. Habitus, fig. 32.

Labrum short, almost rectilinear in front, sides rounded; surface rugulate. Cephalic contours, fig. 2. Clypeus flat, marginal ridges distinct; surface punctate-rugulate; clypeofrontal suture only laterally noticeable. Frons with pair of small, widely separated tubercles connected by feeble, virtually rectilinear ridge; general surface scarcely raised, between the eye-canths irregularly crowdedly punctate, almost punctate-rugulate; to the vertex this sculpture passes into double punctation; primary punctures approximately isodiametric, rather coarse, well-defined, closely and irregularly set, their diameters ca. 0.1 mm; secondary punctures distinct, their diameters roughly one-fifth of those of the primaries, mostly separated by at least their own diameter; frontolateral ridge indistinct. Eye-canthus with raised anterior margin, sculpture punctate-rugulate. Maximum length of head (exclusive of labrum) 1.95, maximum width 2.70 mm; ratio l/w 0.73.

Pronotal contours, fig. 16; surface of pronotum evenly convex, only surface immediately behind the anteromedian border depressed; anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; pronotal base medially marginate. Pronotal punctation double; primary punctures approximately isodiametric, rather coarse, well defined and distinctly impressed, irregularly distributed, closely set, except on paramedian parts of disc; densities on sublateral surface ca. 30/sq. mm, their diameters ca. 0.1 mm; secondary punctures numerous, distinct, evenly distributed. Median length of pronotum 2.8, maximum width 4.7 mm; ratio l/w 0.60. Scutellum deltoid, with arcuate apex; surface virtually impunctate.

Juxtasutural punctures of elytron small, indistinct. Discal striae of elytron weakly impressed, striae on lateral declivity not impressed; punctures in striae approximately isodiametric, distinct, densely arranged, separated by a few times their diameters, which are ca. 0.05 mm; depressed peripunctural surface affecting interstriae. Discal interstriae hardly convex, with numerous minute punctures.

Fore tibia with 7 external denticles, their size decreasing proximad; terminal spur well developed, reaching approximately halfway tarsal segment 2. Femora all moderately setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number on outer side of right middle tibia 3 + (2), on right hind tibia also 3 + (2); crests of non-apical elevations arcuate, apical one of middle tibia slightly emarginate; number of fossorial spines along crest of anteapical elevation on right hind tibia ca. 17, intermediate ones smaller than outer ones; spur of hind tibia scarcely tapering, nearly reaching tarsal segment 3.

Identification. — *Bolbogonium addendum* makes a comparatively pauperized impression, and one wonders whether this has to do with marginal geographic distribution or with mere individual variation. As with *B. bicornutum*, the dorsal outline of the clypeus is trapeziform; the frontal elevation is diminutive compared to *bicornutum*. The posterior declivity of the vertex and the anterior impression of the pronotum are ill pronounced.

Material examined. — Holotype only (P), which has the following label data: „Museum Paris/Cochinchine/Mont de Chaudoc/Harmand 1877”, „518/77”, „Museum Paris/Hte-Vera Paz/Bocourt 188—66”, „groupe de/Bolboceras triangulum West./ Asie!! Bolboceras (Amechanus”. Paulian (1945: 41) already mentioned this

specimen. It undoubtedly belongs in *Bolbogonium*, and I think that the first-mentioned label is the correct one.

***Bolbogonium bicornutum* sp. nov. (figs. 3, 17, 33)**

Description (holotype, female). — Approximate length 11.5, width 6.5, height 5.5 mm. Orange-brown, shiny; tips, ridges, margins, sutures more or less infuscated; pilosity yellowish. Habitus, fig. 33.

Labrum short, slightly emarginate in front, sides widely rounded, surface rugulate. Cephalic contours, fig. 3. Clypeal margins raised; surface crowdedly punctate to malleate-punctate; clypeofrontal suture distinct laterally. Frons with pair of stout subconical tubercles between eye-canths; tubercles connected by transverse saddle steeply descending to clypeofrontal transition, posterior surface gently sloping down to vertex; frons and vertex with distinct scattered, medium-sized, isodiametric punctures; punctures crowded just below black tubercular tips, elsewhere separated by a few times their diameters, which are ca. 0.05 mm; density medially ca 10/0.25 sq. mm; between these punctures several smaller, ill-defined, shallow punctures are noticeable; frontolateral ridge indistinct. Eye-canths with raised margin, surface punctate-rugulate. Maximum length of head (exclusive of labrum) 2.55, maximum width 3.55 mm; ratio l/w 0.72.

Pronotal contours, fig. 17; anterior declivity characteristically, shallowly impressed; impression topped by gently declivous bisinuate crest, its median prominence not sharply projecting cephalad, discal midline shallowly depressed; anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; pronotal base medially marginate, laterally lined with punctures. Pronotal punctation double; anterior impression, discal depression and lateral declivities with numerous scattered, approximately isodiametric, well-defined, infuscated punctures, mostly separated by at least one time their diameters, which are ca. 0.08 mm.; densities halfway lateral declivity ca. 20/sq. mm.; secondary punctures sparse, moderately evenly distributed, their diameters diminutive compared to primary ones. Median length of pronotum 3.9, maximum width 6.5 mm; ratio l/w 0.59. Scutellum deltoid with slightly sinuate sides; surface with numerous small scattered, distinct punctures, closely set in front, elsewhere sparse.

Elytron with only stria 1 shallowly impressed, others are merely series of punctures; juxtasutural series of punctures well-developed. Strial punctures large, resembling those of pronotum, regularly spaced, diameters on disc ca. 0.08 mm., mostly separated by two or three times their diameters. Interstriae 2 etc. not noticeably convex, their surface with minute, indistinct, sparse punctures.

Fore tibia with 7 or 8 external denticles, their size decreasing proximad; terminal spur of both fore tibiae missing. Femora all moderately densely setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number in right middle tibia 3 + (3), in right hind tibia 4 + (2); crest of non-apical elevations arcuate, apical crest of middle tibia angulate; number of fossorial spines along crest of anteapical elevation in right middle tibia 13; spines approximately equal-sized; only one slightly bent, acuminate spur and two tarsal segments present in right middle tibia, other accessories of middle and hind tibiae missing.

Identification. — *Bolbogonium bicornutum* is easily recognizable by the shape of the head, the dorsal outline of the clypeus being perfectly trapeziform, the frons bearing a remarkably high transverse elevation. Furthermore, the outline of the punctate impression on the anterior declivity of the pronotum is very characteristic. The elytral striation is most superficial, while the stria punctures are rather coarse, sharply defined.

Material examined. — Holotype only (M), from India: Calcutta.

***Bolbogonium pseudopunctatissimum* sp. nov. (figs. 4, 18, 34)**

Description (holotype, male). — Approximate length 7.5, width 5, height 4 mm. Brown, shiny; tips, ridges, margins, sutures more or less infuscated; pilosity yellowish. Habitus, fig. 34.

Labrum emarginate in front, sides widely rounded, surface rugulate-punctate. Cephalic contours fig. 4. Clypeus with raised anterolateral angles; surface rugulate-punctate; marginal ridge distinct; clypeofrontal suture distinct. Frons with pair of tubercles connected by low arcuate ridges; punctation of frontovertex double ($\times 25$), contiguous in front, less dense on disc, where densities of primary punctures are 13-17/0.1 sq.mm, diameters ca. 0.08 mm; punctures well defined, distinctly impressed, isodiametric; frontolateral ridge distinct. Eye-canthus with weakly raised anterior margin, surface contiguously punctate. Maximum length of head (exclusive of labrum) 1.90, maximum width 2.40 mm; ratio l/w 0.79.

Pronotal contours, fig. 18; anterior declivity only with subhorizontal base, lacking impression; transverse discal crest subobsolete, discal midline shallowly impressed; base medially marginate. Pronotal punctation double, laterally triple ($\times 50$); primary punctures sparse on paramedian discal surface; secondary punctures large, isodiametric, distinctly impressed, tertiary punctures well defined, isodiametric, equal-sized; densities of primary punctures sublaterally 8-12/0.25 sq. mm, diameters of primary, secondary and tertiary punctures 0.15, 0.08 and 0.01 mm respectively. Median length of pronotum 2.5, maximum width 4.6 mm; ratio l/w 0.54. Scutellum deltoid, moderately punctate.

Juxtasutural stria of elytron present; discal striae of elytron shallowly impressed. Strial punctures distinctly impressed, well defined, isodiametric, their diameters ca. 0.05 mm, separated by 1-2 times their own diameter; peripunctural impressions affect interstrial surface. Interstria 1 distinctly convex, other discal interstriae very weakly convex; punctation sparse, secondary punctures just visible at magnification $\times 50$.

Fore tibia with 7 external denticles, their size decreasing proximad; terminal spur well developed, reaching to apex of tarsal segment 2. Femora all moderately densely setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number in right middle tibia 3 + (2), in right hind tibia 3 + (2); crest of non-apical elevations arcuate, apical elevation of middle tibia emarginate; number of fossorial spines along crest of anteapical elevation on right middle tibia ca. 10, all nearly equal-sized; spurs of hind tibia slightly tapering but with rounded apex, reaching to apex of tarsal segment 2.

Variation. — Length 7.5-11 mm. Holotype with obsolescent pronotal crest, which is slightly better defined in the paratypes.

Identification. — Because of its bituberculate frons, this species was confounded with *Bolbogonium punctatissimum*. It differs from that species by its produced clypeal angles, the ridge connecting the frontal tubercles, the poorly pronounced pronotal crest and the arcuate fossorial elevations on middle and hind tibiae. The frontal and pronotal characters mentioned also separate *pseudopunctatissimum* from its closest relative, *triangulum*. Contrary to the other species in the *triangulum* group, the pronotal base of *pseudopunctatissimum* is incompletely marginate.

Material examined. — 3 specimens.

Holotype with label reading „Musoorie/Mackenzie coll./10.vii-20.x.22” (BM). Paratypes, 1 ♂ from Himalaya (BM), and 1 ♂ from Himachal Pradesh: Simla, viii-1898 (SMT).

***Bolbogonium triangulum* (Westwood) comb. nov.**

(figs. 5, 6, 20, 26-31, 35-37)

Bolboceras triangulum Westwood, 1852: 26 (type-loc. Mussoree), pl. 4 figs. 20, 20a.

Bolboceras (Bolbogonium) triangulum; Boucomont, 1911: 340 (type-sp. of the subgenus); Boucomont, 1912: 14 (in catalogue).

Notes. — There are two groups of specimens here placed under *triangulum*, which at first sight differ by their frontal ornamentation (figs. 5, 6). One group, agreeing with the type, proved to consist of females; the other proved to consist of males; sometimes both forms were found in the same series. As no other morphological differences could be found, I consider the frontal ornamentation in this species a sexual character, despite the fact that such dimorphism was not found in other species. Furthermore, there is some variation in the arrangement of the frontal protrusions (compare figs. 35 and 36). More material is needed to confirm the present interpretation of *B. triangulum*.

Description. — Approximate length ♂, 7.5-10, ♀, 7.5-12 mm. Brown, orange or yellow; shiny; pilosity yellowish. Habitus, figs. 35-37.

Labrum short, emarginate in front, sides widely rounded, surface rugulate-punctate. Cephalic contours, figs. 5 (♂), 6 (♀). Clypeal surface rugulate-punctate; anterolateral angles of clypeus produced; clypeofrontal suture distinct. Frons with pair of approximated tubercles (♂), or with transverse, at the ends tuberculate ridge plus median interocular tubercle (♀); frequently with elongate callosity on clypeofrontal transition; frontolateral ridge distinct, extending to acute crest limiting vertex; anterior surface of frons rugulate-punctate; posterior surface punctate, punctures usually more abundant in ♂. Eye-canthus rugulate-punctate, with raised anterior margin.

Pronotal contours, fig. 20; anterior declivity with well-defined horizontal base, topped by distinct W-shaped crest plus lateral cavity; midline distinctly impressed, well defined behind median protrusion; pronotal borders entirely marginate. Pronotal punctation triple; secondary punctures very distinct, their diameters ca. one-fifth of the primaries; tertiary punctation scarcely distinct ($\times 50$); primary punctation dense along discal midline, very dense or crowded laterally, punctures

deep, well defined; anterior declivity microreticulate, opaque. Scutellum (fig. 26) deltoid, densely, distinctly punctate.

Elytral contours, fig. 26; juxtasutural punctures fine. Elytral striae discally weakly impressed; punctures moderately defined, separated by 1-3 (or 4) times their diameters. Interstriae weakly convex, with very fine punctures, separated by several times their diameters.

Fore tibia (fig. 30) with 7 external denticles, their size decreasing proximad; terminal spur reaching to tarsal segment 2. Femora all moderately setose beneath, without notable details. Middle and hind tibiae (fig. 29) with spinose fossorial elevations increasingly developed distad, two or three non-apical elevations having a complete arcuate crest with ca. 15 approximately equal spines; terminal spurs well developed, approximately as long as tarsal segments 1 + 2.

Identification. — *Bolbogonium triangulum* females are immediately recognizable by their characteristic frontal ornamentation. Males (as interpreted here, see above) may be confounded with other species with a bituberculate frons. Within the *triangulum* group with its produced anterolateral clypeal angles, only *pseudopunctatissimum* has two frontal tubercles, but these are less approximated than in *triangulum*, and they are connected by a transverse ridge. In *triangulum* the pronotal crest is nearly always more strongly pronounced than in *pseudopunctatissimum*. The secondary punctures on the pronotum of *triangulum* are much larger in proportion to the primaries than in *pseudopunctatissimum*.

Material examined. — 36 specimens.

Holotype from India with label „Ind. or./Mussoore/in cow dung” (BM). I doubt if this ecological remark indicates a regular habit. Further specimens as follows (if sex is indicated this was established by extraction of genitalia).

India: Bengal, no further details (2 ♂, SMT, one labelled by Boucomont as *B. punctatissimum*); Bara Taunda [?], x. 1927, Konietzko (1, BH); Buxar (2 ♂, 1 ♀, SMT); Cawnpore [Kanpur], 12.i.1921, Vernon (1, BM); Chapra, Mackenzie (2 ♀, BM); Deccan (1, P); Dehra Dun, 13.vii.1928 (1 ♂, BM); Dhara, v.1943 (1 ♀, Forest Research Inst. and Colleges, Dehra Dun); Calcutta (1, M); Haldwani: Chakata Range, 23.vi.1930, Chatterjee (1 ♂, L); Kumaon (1 ♀, BM); Motinala R., 25.vi.1927, Chatterjee (1 ♀, BM); Naldera, 29.vi.1938, Beeson, in soil (1 ♀, Forest Research Inst. and Colleges, Dehra Dun); Pusa, 5.xii.1904, Watson (1 ♀, BM), 17.vii.1915, at light (1 ♀, BM), 1.i.1916, Bahadur, at light (1 ♀, BM), 2.iii.1920, Austin (1 ♀, BM), Pusa without further data (1 ♀, BM); Simla (1 ♀, BM). North India, no details (1 ♂, BM). — Burma, (1 ♂, seen by Boucomont, 1 ♀ with perfectly straight frontal ridge, BM). — Pakistan: Karachi, Bell (3 ♂, 1 ♀, 1, BM); Murree (1 ♂, seen by Boucomont, BM); Quetta, vii.viii.1933, Samuel (1 ♀, BM), vii.1936, Nazeer, peach plot, light trap (1 ♀, BM; frontal elevations poorly pronounced); Tarnab, 24.v.1916, Fletcher (1 ♂, BM; fig. 35).

***Bolbogonium impressum* (Wiedemann) comb. nov. (figs. 7, 19, 38)**

Scarabaeus impressus Wiedemann, 1823: 6 (type-loc. Bengal).

Bolboceras impressum; Boucomont, 1902: 5 (in catalogue); 1912: 10 (in catalogue).

Description. — Approximate length 9.5-13 mm. Brown, largely shiny; pilosity yellowish. Habitus, fig. 38.

Labrum short, slightly emarginate in front, sides widely rounded, surface rugulate. Cephalic contours, fig. 7. Clypeus shallowly concave behind strongly produced anterolateral angles; midline with elongate callosity interrupting distinct, virtually rectilinear clypeofrontal suture; clypeal surface entirely malleate-rugulate. Frons raised between eye-canths, medially with stout tubercle, the apex of which may be slightly bifid; surface malleate-rugulate, posteriorly normally punctate; frontolateral ridge distinct. Vertex shallowly depressed, arcuate lateral margins distinctly raised; punctation of vertex double; primary punctures scattered, approximately isodiametric, shallow but distinct, laterally closely set, medially mostly separated by a few times their diameters; secondary punctures minute, scarcely discernable ($\times 50$), but numerous, evenly distributed. Anterolateral angle of eye-canthus raised, sculpture like that of clypeus and frons.

Pronotal contours, fig. 19; anterior side with conspicuous, more or less opaque impression; declivity topped by virtually W-shaped crest with distinct median protrusion; base of declivity virtually horizontal, its posterior limit nearly paralleling superior crest; surface in front of lateral part of superior crest with rugulate-punctate cavity; pronotal borders entirely marginate. Pronotal punctation triple; primary punctation sparse beside impressed discal midline, close to crowded laterally, anteriorly, and on discal midline; punctures distinct, mostly isodiametric, laterally more or less irregular; secondary punctures very small, their diameters about one-tenth of the primaries, evenly distributed discally; tertiaries scarcely noticeable ($\times 50$). Scutellum deltoid; closely punctate, secondary punctures minute, numerous, evenly distributed.

Juxtasutural punctures of elytron fine. Discal striae of pronotum shallowly impressed; punctures infuscated, small, separated by 2-4 times their diameters. Interstriae very weakly convex, punctation double; primary punctures sparse, scattered, small, approximately isodiametric, separated by several times their diameters; secondary punctures minute, numerous, evenly distributed.

Fore tibia with 8 external denticles, their size decreasing proximad; terminal spur reaching to tarsal segment 2. Femora all moderately setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad, two or three non-apical ones having a complete, arcuate crest; anteapical crest with 15-20 approximately equal spines; terminal spurs well developed, nearly as long as tarsal segments 1 + 2.

Identification. — *Bolbogonium impressum*, the largest species in the genus, has a single well-pronounced transverse tubercle on the middle of the frons, by which it is immediately separated from the other species in the *triangulum* group. *B. wiebesi* bears a similar frontal tubercle, but differs in shape of clypeus, sharpness of pronotal crest, general sculpture of dorsum, etc.

Material examined. — 6 specimens.

Holotype from Bengal (Copenhagen museum). Further specimens as follows.

India: Dehra Dun, leg. Asmadon (1); Pusa, i.1921, leg. Senior White (1♂), 16.ix.1916, leg. Fletcher (1♂); Simla, vii.1909 (1♀) (all BM); another specimen from Bengal without details (1♂, SMT), figured here.

***Bolbogonium scurra* sp. nov. (figs. 8, 22, 39)**

Description (holotype, male). — Approximate length 11, width 6, height 5 mm. Orange-yellow, shiny; tips, ridges, margins, sutures, punctures more or less infuscated; pilosity yellowish. Habitus, fig. 39.

Labrum long, emarginate in front, sides widely rounded, surface rugulate-punctate. Cephalic contours, fig. 8. Clypeus with distinctly raised anterior margin; lateral ridges distinct; surface irregularly rugulate-punctate. Frontal elevation situated immediately against clypeofrontal suture, which is slightly shifted forward; elevation consisting of a V-shaped saddle connecting a pair of infuscated tips; anterior declivity of elevation very steep, closely, finely punctate, posterior declivity gently sloping to vertex, punctate-rugulate; lateral declivity with similar sculpture. Disc of frontovertex virtually flat, very sparsely punctate, sides and posterior declivity of vertex more densely punctate; punctures approximately isodiametric, moderately defined, distinctly impressed, their diameters ca. 0.05 mm, densities centrally scarcely exceeding 5/0.1 sq. mm. Lateral delimitation of vertex formed by distinct, but not particularly raised, arcuate crest. Eye-canthus with raised anterior margin, sculpture punctate-rugulate, adjacent section of frontolateral ridge obsolescent. Maximum length of head (exclusive of labrum) 2.50, maximum width 3.15 mm; ratio 1/w 0.80.

Pronotal contours, fig. 22; anterior declivity of pronotum impressed, but lacking distinct horizontal base behind apical border; superior crest moderately pronounced, median protrusion distinct, discal midline shallowly impressed; anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; base marginate. Pronotal punctation double; base of anterior declivity abundantly punctate, sides closely punctate; remaining surface also with abundant primary punctures, except around protrusion and on paramedian parts of disc, where secondary punctation is dominant; primary punctures large, isodiametric, distinctly impressed and generally well-defined; diameters of sublateral punctures ca. 0.07 mm (increasing laterad), their densities 7-10/0.25 sq. mm (increasing laterad); secondary punctures fine, isodiametric, sizes variant. Pronotal median length 3.1, maximum width 6.1 mm; ratio 1/w 0.50. Scutellum deltoid, finely punctate; micropunctures ($\times 75$) present.

Juxtasutural punctures of elytron very distinct. Discal striae of elytron shallowly impressed; punctures infuscated, deeply impressed, exceedingly well-defined, isodiametric, locally irregularly spaced, their diameters ca. 0.05 mm; peripunctural impressions indistinctly affecting interstrial surface; stria 2 abbreviated behind. Interstriae very weakly convex, with numerous fine punctures, generally separated by a few times their diameters, which are ca. 0.07 mm.

Fore tibia with 7 external denticles, their size decreasing proximad; terminal spur well developed, reaching halfway tarsal segment 2. Femora all setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number in right middle tibia 3 + (2), in right hind tibia also 3 + (2); crests of non-apical elevations arcuate; number of fossorial spines along crest of anteapical elevation on right middle tibia 12, all

approximately equal-sized; spurs of hind tibiae with rounded tip, not tapering, reaching segment 3 of tarsus.

Variation. — Length 8.5–11 mm. The three specimens at hand are, apart from the usual differences related to size, very similar.

Identification. — *Bolbogonium scurra* is close to *insidiosum*, from which it differs primarily by its flat vertex, its different V-shaped frontal elevation (the legs of the V being wide apart), and its trapeziform clypeus.

Material examined. — 3 specimens.

Holotype from South India: Coimbatore, vi.1966, leg. P.S. Nathan (Howden collection). Two paratypes, also from Coimbatore, xi.1966, leg. P.S. Nathan (Howden collection, L).

***Bolbogonium insidiosum* sp. nov. (figs. 9—12, 23, 40)**

Description (holotype, male). — Approximate length 8.5, width 5, height 3.5 mm. Yellow-brown, shiny; tips, ridges, margins, sutures, punctures more or less infuscated; pilosity yellowish. Habitus, plate 1.

Labrum emarginate in front, sides widely rounded, surface rugulate-punctate. Cephalic contours, fig. 9. Clypeus surface rugulate-punctate; sides limited by ridge, protuberant anteromedially. Frontal elevation situated immediately against clypeofrontal suture, which is slightly shifted forward; elevation U-shaped, anteriorly protuberant, on either side terminating at well-developed tubercle; interior surface of U punctate-rugulate, elevated; sides of frons punctate-rugulate as well; frontolateral ridge distinct. Vertex with large U-shaped, sparsely punctate impression, laterally limited by acute crest. Eye-canthus with raised anterior margin, surface indistinctly rugulate. Maximum length of head (exclusive of labrum) 2.10, maximum width 2.50 mm; ratio 1/w 0.85.

Pronotal contours, fig. 22; anterior declivity impressed, but without horizontal base behind apical border; superior crest moderately pronounced, median protrusion distinct, discal midline shallowly impressed; anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; base marginate medially. Pronotal punctation generally sparse, double ($\times 25$), more abundant on midline and lateral declivities; primary punctures large, isodiametric, distinctly impressed, generally well defined; their densities sublaterally 10–12/sq. mm, diameters somewhat less than 0.1 mm. Median length of pronotum 2.45, maximum width 4.75 mm; ratio 1/w 0.52. Scutellum deltoid, finely punctate; micropunctures ($\times 75$) present.

Juxtasutural punctures of elytron distinct. Discal striae of elytron shallowly impressed; punctures large, deeply impressed, well defined, locally irregularly spaced, their diameters ca. 0.05 mm, separated by 2–4 times this diameter; peripunctural impressions slightly affecting interstitial surface; stria 2 extending onto posterior declivity. Discal interstriae weakly convex with fine punctures, generally separated by few times their diameter.

Fore tibia with 8–9 external denticles, their size decreasing proximad; terminal spur well developed, reaching halfway tarsal segment 2. Femora all setose beneath, without notable details. Middle and hind tibia with spinose fossorial

elevations, increasingly, developed distad; number in right middle tibia 2 + (3), in right hind tibia 3 + (2); crests of non-apical elevations arcuate; number of fossorial spines along crest of anteapical elevation on right middle tibia ca. 15; Spurs of hind tibiae with rounded tip, not tapering, reaching tarsal segment 3.

Variation. — Length 7—11 mm. This species is extremely variable in shape of clypeus, ornamentation of frons and vertex, development of the anteromedian protrusion of pronotum. The variation in the shape of the clypeofrons is illustrated in figs. 10—12.

Identification. — *Bolbogonium insidiosum* is recognizable by its frontal elevation and the characteristically impressed vertex. As stated in the preceding paragraph, variation is considerable.

The frons may be trituberculate with variably pronounced intervening ridges. The development of the tubercles themselves varies as well, the anterior one independently from the posteriors; in extreme cases only an arcuate ridge is left in front of the posterior pair of tubercles. The degree of impression of the vertex varies strongly, but remains noticeable, at least in the specimens I have seen. Compared to *scurra*, two useful features are the greater extension of elytral stria 2 and the frontal elevation not being a wide-legged V.

Material examined. — 33 specimens.

Holotype from India: Madras: Coimbatore, xi.1964, leg. P.S. Nathan, 1400 ft (M). Paratypes as follows.

India. — Bellary, 1896, De Morgan (1, P, mentioned by Boucomont, 1911: 340); Belgaum (1 ♀, BM); Chinchona, Anomalai Hills, v.1966, Nathan, 3500 ft (1 ♀, Schulze coll.); Coimbatore, xi.1955 (4, CNC), xi.1958 (1, Howden coll.), xi.1962 (1, CNC), x.1962 (2, CNC), xi.1963 (1 ♀, L), i.1964 (6, CNC), xii.1966 (6, Howden coll.), all Nathan, 1400 ft; Hoshangabad, 14-19.ix.1911, T.S.F. [?], at light (1 ♀, BM); Kadanpur [?, indistinct handwriting] (1 ♀, 1, SMT); Kadegaon (1 ♂, 1 ♀, BM, seen by Boucomont); Nagpur, 10.xii.1915 (1 ♀), 2.xii.1917 (1), 26.xii.1918 (1), d'Abreu (all BM); Buldana, Sagoda Purna, 7.iii.1930, Chatterjee (1, BM). A worn ♀ from „India bor.” (BM) excluded from type-series (mentioned by Boucomont, 1911: 341).

***Bolbogonium punctatissimum* (Westwood) comb. nov. (figs. 13, 21, 41)**

Bolboceras punctatissimus Westwood, 1852: 22, pl. 4 fig. 9, 9a (type-loc. Moradabad).

Bolboceras punctatissimum; Boucomont, 1912: 12 (in catalogue).

Description (holotype, not sexed). — Approximate length 8, width 5, height 4 mm. Brownish yellow, shiny; tips, ridges, margins, sutures more or less infuscated; pilosity yellowish. Habitus, fig. 41.

Labrum short, slightly emarginate in front, sides widely rounded, surface sculpture indistinct. Cephalic contours, fig. 13. Clypeal margins raised, particularly anteriorly, marginal ridge obsolete near rounded anterolateral angles; surface closely punctate, punctures small, somewhat irregular, shallow, weakly defined; interspaces not exceeding diameters of punctures, which are ca. 0.05 mm; clypeo-frontal suture laterally distinct. Middle of frons raised between genal angles, with

pair of low transverse elevations; punctation like that of clypeus, but generally closer, almost malleate-punctate; frontolateral ridge indistinct. Lateral delimitation of vertex not marginate, though still abruptly declivous; posterior surface of vertex concavely acclivous; sculpture like that of clypeus and frons. Eye-canthus with raised margin, sculpture like that of frons. Maximum length of head (exclusive of labrum) 1.8, maximum width 2.4 mm; ratio l/w 0.79.

Pronotal contours, fig. 21; anterior declivity impressed; superior crest poorly pronounced, discal midline shallowly depressed, anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; borders entirely marginate. Pronotal punctation double ($\times 50$); base of anterior declivity and sides punctate-rugulate, remaining surface with close primary punctation; punctures small, shallow, locally ill-defined; diameters of discal punctures mostly slightly exceeding 0.05 mm, their densities 50-60/0.25 sq. mm; secondary punctures numerous, extremely fine. Median length 2.8, maximum width 4.7 mm; ratio l/w 0.58. Scutellum deltoid, its surface punctate.

Juxtasutural punctures of elytron indistinct. Discal striae shallowly impressed; punctures slightly infuscated, small, shallow, regularly spaced, peripunctural impressions indistinctly affecting interstrial surface. Interstriae scarcely convex, with scattered primary punctures mostly separated by one or two times their diameters, which are ca. 0.025 mm; secondary punctation as on pronotum.

Fore tibia with 7 external denticles, their size decreasing proximad; terminal spur well developed, reaching to tarsal segment 3. Femora all moderately setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number in right middle tibia 3 + (2) in right tibia 3 + (2); crests of distal elevations emarginate; number of fossorial spines along crest of anteapical elevation in right middle tibia 6 (superiorly) and ca. 9 (inferiorly), inferior spines longer than superior ones; spurs of middle tibia acuminate; those of hind tibia scarcely tapering, with rounded tip, nearly as long as tarsal segments 1 + 2.

Identification. — *Bolbogonium punctatissimum* is closely allied to *B. howdeni* but differs in frontal ornamentation and general sculpture of dorsum. These differences are rather tentative, since the type of *punctatissimum* is the only specimen known to me. Some forms in the *triangulum* group have also a pair of small frontal tubercles, but these are readily distinguished by the produced anterolateral angles of the clypeus.

Material examined. — Holotype only (BM), with label reading "Ind. or./Moradabad/on Evening/in the Ruins/by a Candle".

***Bolbogonium howdeni* sp. nov. (figs. 14, 24, 42)**

Description (holotype, male). — Approximate length 9, width 5, height 4 mm. Light brown, shiny; tips, ridges, margins, sutures more or less infuscated; pilosity yellowish. Habitus, fig. 42.

Labrum rather strongly protruding, almost rectilinear in front, sides rounded; surface rugulate-punctate. Cephalic contours, fig. 14. Clypeus shallowly concave behind raised front margin, lateral borders not distinctly raised; surface entirely

malleate-punctate; clypeofrontal suture indistinct. Raised clypeofrontal disc with 3 small but conspicuous tubercles between genal angles; frontal sculpture similar to that of clypeus; frontolateral ridge indistinct. Vertex closely punctate, punctures approximately isodiametric, small (diameters ca. 0.05 mm), shallow, but distinct. Eye-canthus with raised anterior margin, sculpture rugulate. Maximum length of head (exclusive of labrum) 1.80, maximum width 2.40 mm; ratio 1/w 0.76.

Pronotal contours, fig. 24; anteromedian declivity topped by distinct bisinuate crest; only surface immediately behind anteromedian border distinctly depressed; discal median longitudinal depression shallow; anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; pronotal borders entirely marginate. Pronotal disc crowdedly punctate, punctures approximately isodiametric, well defined, of variable sizes, their diameters rarely reaching 0.1 mm; lateral declivities punctate-rugulate. Median length of pronotum 2.8, maximum width 5.1 mm; ratio 1/w 0.57. Scutellum deltoid, apex shortly arcuate; surface closely punctate.

Juxtasutural punctures of elytron weakly impressed. Striae on lateral declivity of elytron indistinct owing to strongly transversely wrinkled surface; punctures of striae 2 et seqq. poorly defined, regularly spaced, their diameters ca. 0.1 mm mostly separated by less than three times this diameter. Discal interstriae scarcely convex, with scattered small but distinct punctures, their diameters ca. 0.05 mm; micropunctuation hardly visible ($\times 50$).

Fore tibiae with 7 external denticles; terminal spur well developed, reaching halfway segment 2. Femora all moderately setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number in right middle tibia 3 + (1), in right hind tibia 3 + (2); crest of distal elevations emarginate; number of fossorial spines along crest of anteapical elevation ca. 4 (superiorly) and ca. 4 (inferiorly), their sizes variant; spurs of hind tibiae not tapering, with rounded tip, reaching approximately halfway tarsal segment 2.

Variation. — Length 9-11 mm. The four specimens at hand are, apart from the usual differences related to size, very similar.

Identification. — *Bolbogonium howdeni* is easily recognizable by the presence of three small tubercles on the frons and by its heavily sculptured dorsum (contiguously punctate, malleate-punctate, or punctate-rugulate). *B. punctatissimum* is certainly closely allied with *howdeni*, but clearly differs in the aforesaid characters.

Material examined. — 4 specimens.

Holotype from India: Bihar; Pachrukhi, 1927 (Howden collection); Howden correctly labelled it as being allied with *punctatissimum*. Paratypes from India: Chapra, leg. Mackenzie (1 ♀, BM); Pusa, 30.xi.1904 (1, BM). — Pakistan: Sind (1 ♀, P).

Note. — This species is dedicated to Dr. H. F. Howden, specialist in Geotrupidae, professor of biology at Carleton University, Ottawa.

***Bolbogonium wiebesi* sp. nov. (figs. 15, 25, 43)**

Description (holotype, male). — Approximate length 10, width 6.5, height 4.5 mm. Brown, shiny; tips, ridges, margins, sutures more or less infuscated; pilosity brownish. Habitus, fig. 43.

Labrum quite prominent, slightly emarginate in front, sides widely rounded, surface indistinctly rugulate. Cephalic contours, fig. 15. Front margin of clypeus strongly raised, forming a transverse costa; lateral limiting crests of horizontal surface obsolete. Frons with very weakly bifid transverse tubercle; clypeofrontal suture vaguely distinct laterally; frontolateral ridge indistinct. Eye-canthus with raised outer margin. Cephalic surface almost entirely malleate-punctate, impressions on posterior declivity of frontal tubercle somewhat transversely confluent; separate units medium-sized, their diameters just behind the eyes slightly over 0.05 mm. Maximum length of head (exclusive of mouthparts) 2.45, maximum width 2.40 mm; ratio l/w 0.83.

Pronotal contours, fig. 25; anterior side with distinct impression topped by W-shaped crest; discal midline very shallowly impressed; anterolateral angles obtuse, posterolateral angles obsolete, widely rounded; borders entirely marginate. Pronotal punctation triple (magnification $\times 50$); disc and anterior declivity with close primary punctation, punctures rather coarse, shallowly impressed though well defined, approx. isodiametric; their diameters ca. 0.07 mm, densities just beside discal midline ca. $10/0.25$ sq. mm; density of primary punctures increasing laterad, marginal zone punctate-rugulate; secondary punctures discally most distinct, scattered, approximately isodiametric, diameters ca. 0.03 mm, densities beside discal midline almost $20/0.25$ sq. mm; tertiary punctures numerous, moderately evenly distributed on pronotal disc. Median length of pronotum 3.4, maximum width 6.2 mm; ratio l/w 0.55. Scutellum deltoid, with scarcely sinuate sides; surface with numerous distinct punctures, slightly smaller than primary ones of pronotal disc, diameters ca. 0.05 mm; secondary punctation dense, punctures resembling tertiaries of pronotal disc.

Juxtasutural punctures of elytron indistinct. Striae discally lightly impressed; punctures small, diameters scarcely exceeding 0.05 mm, separated by a few diameters; peripunctural impressions slightly affecting interstrial surface. Interstriae very slightly convex, punctation double; primary punctures scattered, distinct, approximately isodiametric, diameters less than 0.05 mm, separated by at least one diameter; secondary punctation remarkably close, punctures evenly distributed, fine, diameters less than one-tenth of the primary ones.

Fore tibia with 7 external denticles, their size decreasing proximad; terminal spur of fore tibia well developed, extending a little beyond tarsal segment 1. Femora all setose beneath, without notable details. Middle and hind tibiae with spinose fossorial elevations increasingly developed distad; number in right middle tibia 3 + (2); distal crests emarginate, number of fossorial spines along crest of anteapical elevation 5 (+ ca. 5 long setae) (superiorly), and 5 (inferiorly); spurs of middle tibia acuminate, those of hind tibia scarcely tapering, with rounded tip, slightly shorter than tarsal segments 1 + 2.

Identification. — *Bolbogonium wiebesi* is recognizable by the large frontal

tubercle; *impressum*, similar in this character, differs primarily by the produced anterolateral angles of its clypeus. In *wiebesi* the anterior margin of the clypeus is strongly costate; furthermore, the pronotal crest is remarkably sharp and the entire dorsum is heavily punctate.

Material examined. — Holotype only (BM), with labels reading "Burma/1919-103", "1/5".

Note. — This species is dedicated to Dr J. T. Wiebes, professor of systematic zoology and evolutionary biology at the State University of Leiden.

NOTES ADDED IN PROOF

Two recent descriptions of *Bolbogonium* extend the generic range (fig. 1) some hundreds of kilometers into Afghanistan. *Bolbogonium kabakovi* Nikolajev (1976: 693) from the Laghman province confirms the introductory notes given above under *B. triangulum* Westw., and I suspect a synonymy here. *Bolbogonium kabolicum* Nikolajev & Kabakov (1977: 646) from Kabul would easily key to point 7 in my key, and then seems immediately recognizable by its peculiar frontal ornamentation (l.c.: fig. 1).

ACKNOWLEDGEMENTS

My protracted study of Asian Bolboceratini is possible only thanks to the patient assistance of several colleagues and their technicians. Relevant to the material dealt with in this paper are:

M. E. Bacchus (London), A. Bons (Paris), P. N. Chatterjee (Dehra Dun), A. Descarpentries (Paris), H. Freude (Munich), F. Hieke (Berlin), H. F. Howden (Ottawa), R. Krause (Dresden), N. Møller Andersen (Copenhagen), R. D. Pope (London), J. Schulze (Berlin).

Critical comments on drafts of this paper were received from H. F. Howden (Ottawa), P. J. Kuijten (Leiden), J. T. Wiebes (Leiden).

The habitus drawing (plate 1) was produced by A. Bos, the photographs were printed by C. Hoorn, both on our museum staff.

Visits to institutions abroad were made possible by grants from the Uyttenboogaart-Eliassen Stichting (Amsterdam).

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APPENDIX

CHARACTERS AND CHARACTER STATES RELEVANT TO A SUPRASPECIFIC CLASSIFICATION OF THE TRIBE BOLBOCERATINI ¹⁾*Head (dorsal)*

- 1 (a) Outline of mandibles (outer margins) symmetrical.
- (b) Outline of mandibles (outer margins) asymmetrical.
- 2 (a) Outer margin of right mandible sinuate, poorly lobed, or simply arcuate.
- (b) Outer margin of right mandible, for the greater part, straight, or nearly so
- (c) Outer margin of right mandible with distinct arcuate lobe.
- (d) Outer margin of right mandible with distinct acute lobe.
- 3 (a) Transverse ridge of labrum present and distinct.
- (b) Transverse ridge of labrum absent, obsolete, or at least indistinct.
- *4 (a) Outline of clypeus in dorsal view (male) approximately trapeziform.
- (b) Outline of clypeus in dorsal view (male) approximately semicircular.
- (c) Outline of clypeus different from preceding alternatives, e.g., very strongly modified by marginal protrusion(s) — to be specified for each case.
- *5 (a) Perimarginal ridge of clypeus present and unmodified.
- (b) Perimarginal ridge of clypeus present and modified — but different from alternative (d).
- (c) Perimarginal ridge of clypeus entirely or largely obsolete.
- (d) Perimarginal ridge transformed into X-shaped ridges (dorsal view), cross-point with or without tubercle.
- *6 (a) Base of any cephalic protrusion(s) restricted to clypeus, frons, or vertex, or situated on clypeofrontal transition.
- (b) Base of usually well-developed cephalic protrusion largely covering both clypeus and frons.
- 7 (a) Clypeus lacking single anteromarginal protrusion.
- (b) Clypeus with single anteromarginal protrusion — but not as sub character state 4 (c).
- *8 (a) Clypeal disc with transverse ridge or pair of isolated elevations.
- (b) Clypeofrontal transition (suture) with transverse ridge or pair of isolated elevations.
- (c) Clypeal disc with a single tubercle — but not as sub character state 6 (b).
- (d) Clypeofrontal transition (suture) with a single tubercle — but not as sub character state 6 (b).
- *9 (a) Frontal disc with transverse ridge or pair of isolated elevations.
- (b) Frons with pair of distinct para-ocular protrusions.
- (c) Frons or vertex with a single tubercle.
- 10 (a) Frontovortex lacking distinct impression(s), at most shallowly concave.
- (b) Frontovortex with distinct impression(s).
- *11 (a) Vertex lacking transverse ridge.
- (b) Vertex with distinct transverse, straight or arcuate ridge.
- *12 (a) Vertex not sharply separated from tempora.
- (b) Vertex separated from tempora by ridge.
- *13 (a) Tempora not produced.
- (b) Tempora more or less produced, angulate.
- 14 (a) Vertex gently sloping to pronotal apex.
- (b) Vertex posteriorly limited by vertical declivity.
- 15 (a) Anterior margin of eye-canthus simply arcuate.
- (b) Anterior margin of eye-canthus straight, shortly rounded or with lateral angle and/or tubercle.
- *16 (a) Eye-canthus and temporal lobe separated.
- (b) Eye-canthus and temporal lobe contiguous, dividing eye in two parts.
- 17 (a) Dorsally visible area of eye small — to be specified for each case.
- (b) Dorsally visible area of eye large — to be specified for each case.

¹⁾ Characters suggested to be of primary diagnostic importance are marked with an asterisk.

Pronotum (male) and scutellum

- 18 (a) Pronotum lacking distinct non-marginal protrusions, simply convex (except for shallow median longitudinal sulcus).
- (b) Pronotum with distinct non-marginal protrusions — characters 19—22 conditional on this character state.
- *19 (a) Pronotum simply retuse anteromedially, declivity surmounted by transverse discal crest; lacking discal paramedian or lateral protrusions.
- (b) Pronotum distinctly concave anteromedially, but lacking transverse discal crest or any other protrusions.
- (c) Pronotum with pairs of paramedian and/or lateral protrusions (usually tubercles); in well-developed forms frequently with anteromedian and/or sublateral impressions.
- *20 (a) Pronotum lacking crest just behind apex proceeding onto lateral declivities.
- (b) Pronotum with crest just behind apex proceeding onto lateral declivities.
- *21 (a) Pronotum not, at the same time, with sharp posterior crest running roughly parallel to base, and anterior surface retuse to strongly concave.
- (b) Pronotum with sharp posterior crest running roughly parallel to base, and anterior surface retuse to strongly concave.
- 22 (a) Pronotal protrusion(s) not restricted to basal area.
- (b) Pronotal protrusion(s) restricted to basal area.
- *23 (a) Pronotal apex lacking pair of small deep impressions.
- (b) Pronotal apex with pair of small deep impressions (bifoveate).
- 24 (a) Pronotal base marginate (at least medially).
- (b) Pronotal base immarginate.
- *25 (a) Pronotal apex medially marginate or immarginate, but unmodified.
- (b) Pronotal apex modified (e.g., tuberculate or with high transverse ridge).
- 26 Conditional on 25 (b).
- (a) Pronotal apex unituberculate (in one known case with long upbent horn).
- (b) Pronotal apex bituberculate, occasionally tubercles confluent or obsolescent.
- (c) Pronotal apex strongly elevated over much of its width (costate or carinate).
- 27 (a) Pronotal apex fringed with narrow velum and/or setae.
- (b) Pronotum lacking velum, but fringed with long setae.
- *28 (a) Scutellum semicircular, semielliptic, sides may be more or less parallel or weakly sinuate in front — character state 29(c) excepted.
- (b) Scutellar sides strongly sinuate (curving laterad in front) — character state 29(c) excepted.
- (c) Scutellum simply triangular.
- (d) Shape of scutellum different form preceding alternatives — to be specified for each case.
- *29 (a) Scutellum very wide ($1/w < 1$).
- (b) Scutellum short ($1/w \approx 1-2$).
- (c) Scutellum elongate ($1/w \geq 2$).

Elytron

- *30 (a) Elytral base immarginate.
- (b) Elytral base marginate (ridged).
- 31 (a) Elytral epipleuron reaching apico-sutural angle.
- (b) Elytral epipleuron obsolete at some distance from elytral apex (at the beginning of the distal curve).
- *32 (a) Elytron with 7 striae between suture and humeral umbone.
- (b) Elytron with 5 striae between suture and humeral umbone.
- (c) Elytron with 9 striae between suture and humeral umbone.
- 33 (a) Stria 5 extending to (near) elytral base.
- (b) Stria 5 obsolete in front.
- *34 (a) Stria 1 terminating at side of scutellum, stria 2 interrupted in front or reaching base of elytron (not basal angle of scutellum).
- (b) Both striae 1 and 2 terminating at side of scutellum (2 occasionally terminating at basal angle of scutellum).

- (c) Stria 1 proceeding to elytral base.
- 35 (a) Elytral striae 2—7 not or only scarcely impressed, intervals (= interstriae) not or only scarcely convex.
- (b) Elytral striae sulcate, intervals distinctly convex.
- 36 Conditional on 35(b).
- (a) Elytral intervals all approximately equally convex.
- (b) Odd intervals of elytral disc (at least juxtasutural one) much more convex than even intervals.
- 37 (a) Humeral angle of elytron unmodified.
- (b) Humeral angle of elytron tuberculate.

Antenna

- 38 (a) Antennal club normal, not thicker than length of pedicel and subsequent flagellar segments combined.
- (b) Antennal club very robust, thicker than length of pedicel and subsequent flagellar segments combined (outer surface of ultimate segment usually distinctly convex).
- *39 Conditional on 38 (b).
- (a) Distal side of club segment 3 evenly convex or nearly so.
- (b) Distal side of club segment 3 remarkably swollen near base.
- *40 (a) Proximal surface of club segment 1 entirely pubescent, lacking glabrous, polished area.
- (b) Glabrous, polished area on proximal side of club gradually passing to pubescent parts.
- (c) Glabrous, polished area on proximal side of well separated from remaining, pubescent surface.
- *41 (a) Distal side of club segment 3 lacking grooves.
- (b) Distal side of club segment 3 with 2 distinct grooves.

Pectus

- 42 (a) Anterior paramedian costae of prosternum distinct.
- (b) Anterior paramedian costae of prosternum obsolete.
- 43 Conditional on 42 (a).
- (a) Prosternum convex or flat (occasionally wrinkled) between anterior paramedian costae.
- (b) Prosternum with median longitudinal ridge, but juxtacoxal surface not deeply concave.
- (c) Prosternum, behind anterior paramedian costae, with longitudinal costa limited by deep juxtacoxal holes.
- (d) Prosternum sulcate (not simply concave) between anterior paramedian costae.
- 44 (a) Prosternum lacking any posteromedian protrusion, not even a longitudinal ridge.
- (b) Prosternum with some posteromedian protrusion.
- 45 Conditional on 44 (b).
- (a) Prosternum lacking posteromedian spine or similar protrusion.
- (b) Prosternum angulate, or with isolated posteromedian spine or similar protrusion.
- *46 Conditional in 44 (b).
- (a) Prosternum not bulbose or otherwise inflated-dilated.
- (b) Prosternum bulbose posteromedially.
- (c) Prosternum with well-developed lanceolate posteromedian process.
- (d) Prosternum with transverse, bidentate posteromedian process.
- *47 (a) Middle coxae (sub)contiguous, anteromedian process of metasternum indistinct.
- (b) Middle coxae distinctly separated, although anteromedian process of metasternum may be strongly narrowed.
- 48 Conditional on 47(b).
- (a) Metasternal process between middle coxae not strongly narrowed.
- (b) Metasternal process between middle coxae strongly narrowed.
- *49 Conditional on 47(b).
- (a) Metasternal disc pyriform in outline.
- (b) Metasternal disc rhomboid in outline.
- (c) Metasternal disc different from preceding alternatives — to be specified for each case.

*50 Conditional on 47(b).

- (a) Metasternal process flat, or nearly so, abruptly retuse in front, with complete perimarginal ridge, adjacent mesosternal declivity more or less concave.
- (b) Metasternal process flat, or nearly so, abruptly retuse in front, lacking perimarginal ridge, adjacent mesosternal declivity more or less concave.
- (c) Metasternal process long and narrow (linear), but not reduced to a sharp carina.
- (d) Metasternal process gradually passing to mesosternum, not limited by some transverse protrusion, lacking longitudinal carina.
- (e) Metasternal process with distinct median longitudinal carina, which may be more or less angulate in front (prow-shaped).
- (f) General surface of metasternal process hunched, different from preceding alternatives.

*51 Conditional on 47(b).

- (a) Metasternal process lacking any particular accessory protrusions.
 - (b) Metasternal process with robust denticle in front.
 - (c) Metasternal process with fine spine or hook in front.
- 52 (a) Mesometasternal suture noticeable at base of declivity.
 (b) Mesometasternal suture obsolete.
- 53 (a) Longitudinal suture of metasternum (largely) obsolete.
 (b) Longitudinal suture of metasternum distinct.

Abdomen

- 54 Structure of stridulatory organ — available data insufficient for classification.

Legs (male)

- 55 (a) Fossorial elevations of middle and hind tibiae with straight, angulate — emarginate, bidentate, of bilobate crest (reference: anteapical elevation of hind tibia).
 (b) Fossorial elevations of middle and hind tibiae with arcuate crest (reference: ditto).
- 56 (a) Middle tibia with a single non-apical fossorial elevation, others completely obsolete or noticeable only as pairs of isolated denticles.
 (b) Middle tibia with two or more complete non-apical fossorial elevations.
- 57 (a) Fore tibia normal.
 (b) Fore tibia strongly dilated.
- *58 (a) Femora indentate.
 (b) Femora dentate (particularly fore femora).
- *59 (a) Terminal spur of fore tibia long and slender, scarcely tapering.
 (b) Terminal spur of fore tibia more or less triangular, with acute apex, occasionally very robust.
- *60 (a) Tarsal segment I of fore-legs short.
 (b) Tarsal segment I of fore-legs remarkably elongate.

Genitalia

- *61 (a) Aedeagus consisting of two parameres.
 (b) Separate parameres indistinct.
- 62 Conditional on 61 (a).
 (a) Parameres strongly sclerotized, without notable accessory elements.
 (b) Parameres sclerotized and strongly modified, i.e. with accessory elements.
 (c) Parameres very small, poorly sclerotized, without notable accessory elements.
 (d) Different from preceding alternatives — to be specified for each case.

Sexual dimorphism

- 63 (a) Armature (sculptural ornamentation) of head and pronotum of male and female belonging to the same species similar.
 (b) Armature (sculptural ornamentation) of head and pronotum of male and female belonging to the same species radically different — to be specified, see characters 4 et seqq., 18 et seqq.

Colours

- 64 (a) Colour uniform throughout, apart from infuscated ridges, sutures, tips, margins, punctures, etc.
(b) Colour not uniform throughout.
- 65 Conditional on 64(a).
(a) Colour some lighter tone of brown.
(b) Colour some very dark tone of brown, or black.
- 66 Conditional on 64(b).
(a) Elytra and pronotum differently, but uniformly coloured.
(b) Elytra and/or pronotum with some colour pattern.

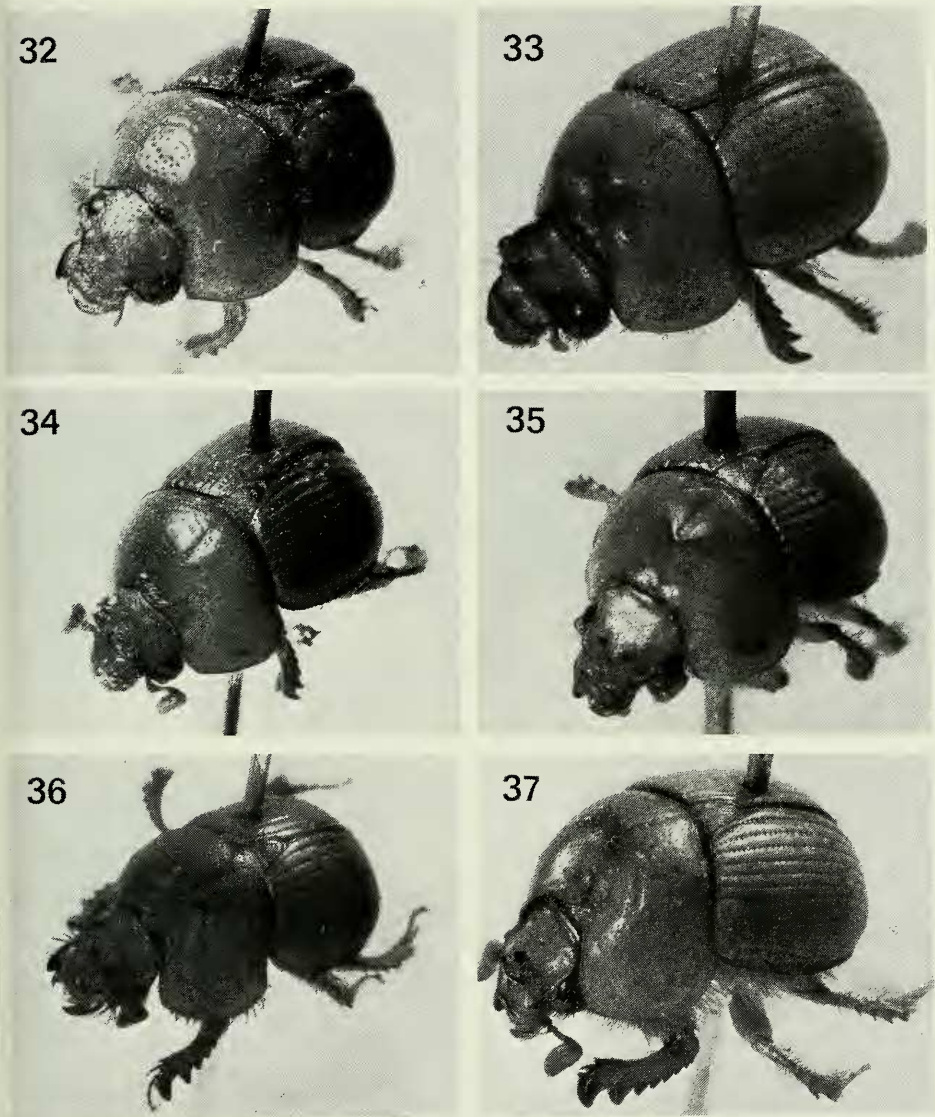


Plate 2. *Bolbogonium* species. 32, *addendum*, holotype; 33, *bicornutum*, holotype; 34, *pseudopunctatissimum*, holotype; 35—37, *triangulum*, ♂ Tarnab (35), ♂ Burma (36), ♀ Kanpur (37), length ca 8, 11.5, 11 mm, respectively.

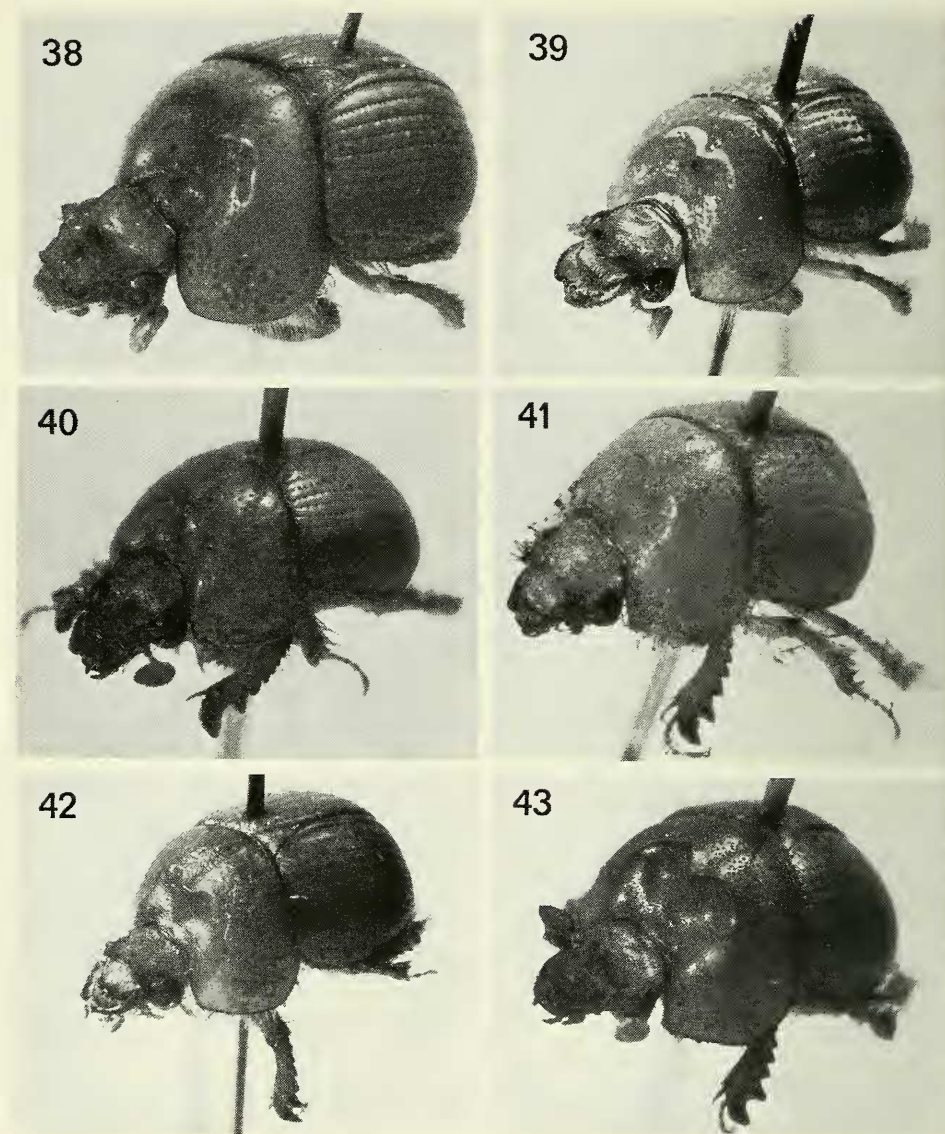


Plate 3. *Bolbogonium* species. 38, *impressum*, ♂ Bengal, length 12.5 mm; 39, *scurra*, holotype; 40, *insidiosum*, holotype; 41, *punctatissimum*, holotype; 42, *howdeni*, holotype; 43, *wiebesi*, holotype.